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10 February 1969

MEMORANDUM FOR THE RECORD

SUBJECT: S-1010 PPA Wrist Disconnects

REFERENCE: (1) [ ] dated 3 February 1969  
(2) [ ] dated 5 February 1969

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1. Because of a recent U.S.A.F. F-104 fatal accident attributed to the accidental disconnect of the pilot's full pressure suit glove at a cabin altitude above 50,000 feet, the accident board's subsequent conclusions and recommendations, and recent message traffic (Ref 1 and 2), the following information is presented for the record.

2. The request for a proposal submitted to the David Clark Co. and their technical proposal for the S-1010 PPA submitted in response, specified that the full pressure suit gloves would be like the S-901J PPA (used in the SR-71). However, it was also stated that all efforts would be made to reduce suit bulk/weight to the maximum extent possible. The S-1010 Prototype that was evaluated in October 1967 had wrist disconnects as pictured in Figure 1A. attached. The wrist disconnect was identical to the S-901J, using a high profile latch, with the exception that a protective flap on the glove that covered the wrist disconnect had been deleted. The primary purpose of the aluminized material flap on the S-901J glove was to prevent heat leakage into the suit via the wrist disconnect if the metal ring came in contact with very hot cockpit walls/canopy in the SR-71. The S-1010 PPA for use in the U-2R did not have this requirement and the flap had been deleted in order to help reduce overall bulk.

3. During an altitude chamber evaluation flight with the prototype S-1010 PPA, a glove became disconnected as the undersigned, as test subject, manually inflated the suit at an altitude of 30,000 feet just prior to ascent to 75,000 feet. At 30,000 feet there was no physiological impairment caused by glove disconnect, so the glove was reconnected, checked, and the flight continued. Upon post-flight analysis and discussion, it was concluded that in evaluating mobility during the chamber flight the high profile latch came in contact with some object in a manner that released it and rotated the

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disconnect to the open position. With subsequent suit inflation, the glove disconnected. The primary fix chosen at this time was to use a low profile latch to lessen or eliminate the likelihood of inadvertently opening the wrist disconnect. The low profile latch selected was that used on the USAF's standard A/P 22S-2 full pressure suit. It was felt that thousands of flights and flight hours on that suit system without known accidental glove disconnects was positive evidence that the low profile latch was the solution we sought. In the personal experience of the undersigned in conducting and participating in hundreds of A/P 22S-2 full pressure suit chamber flights, no accidental glove disconnects had ever been observed. The change to the low profile latch is depicted in Figure IB. attached. As an added precaution, a protective flap was added to the suit sleeve that would cover the wrist disconnect after it was locked and be held in place by velcro hook-tape. This modification is depicted in Figure IC.

4. Normal operation of the S-1010 PPA wrist disconnect (or the standard A/P-22S-2 or the S-901J type) is depicted in Figure IIA. The normal sequence for disconnecting the glove would be as follows:

- a. The disconnect, in the locked configuration, after opening the protective flap if present (i.e., S-1010 or S-901J) is depicted in Figure II A-1.
- b. The latch is opened by pushing (or pulling) it towards the glove, in the direction of the arrow in Figure II A-2.
- c. The wrist disconnect is then unlocked by rotating the ring in a direction  $90^{\circ}$  from the latch opening direction, as indicated in Figure II A-3. Pressure, either mechanical or pneumatic, exerted outward on the glove will then accomplish disconnect.

5. Accidental opening of this style wrist disconnect, as likely occurred in the previously mentioned F-104 accident or S-1010 prototype chamber flight, is visualized to have occurred as depicted in Figure IIB. A force exerted on the latch (or a blow) in an angular direction can result in the latch being released and the ring being rotated to the open position with only the single angular motion involved. A possible accidental disconnect related to this could involve

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the pilot grasping one wrist disconnect with the opposite hand and pulling the sleeve down to relieve pressure on the ends of his fingers exerted by the gloves. If the pilot grasped the disconnect and pulled down and outward in a specific way, unlatching and unlocking of the disconnect could occur.

6. The interim fix used with the S-1010 PPA to prevent accidental disconnect, as outlined in the referenced messages, is depicted in Figure II C. Once the disconnect is locked in the normal fashion, as shown in Figure II C-1, a neoprene O-Ring with a tab attached (Fig. II C-2) is inserted in the space between the wrist disconnect and the glove ring, as seen in Figure II C-3. The O-Ring installed in this fashion prevents the latch from being opened until the O-Ring is removed by means of the attached tab. In the case of the S-1010 PPA use of this interim fix, the sleeve flap is still retained and used.

7. The permanent fix being developed into appropriate mod kit/service bulletin action at the present time is depicted in Figure II D attached. This fix incorporates a lock button/mechanism on the latch. The action required to open the latch involves depressing the new button in a direction that is 180° to the ring opening direction, as shown in Fig. II, D-2. When the new button is depressed, the latch can then be moved outward (Fig. II D-3) and finally, the ring can be rotated to the open position (Fig. II D-4). Even an angular force or blow that can depress the new button and open the latch will not result in accidental glove disconnect because such an angular force is still acting opposite to the opening direction of the disconnect ring. Therefore, once the angular force is released, the latch and lock button will snap back to their locked position. For use with the S-1010 PPA, the new modification will not eliminate the sleeve flap as additional protection.

8. Conclusions and Recommendations:

a. OSA Life Support may have been remiss in not making other USAF users of full pressure suits aware of the accidental glove disconnect encountered during S-1010 PPA prototype chamber evaluations. Since the S-1010 was a prototype at that stage, and the wrist disconnect was not exactly like others in use in every respect, the failure was not thought to have application to other users at the time. Upon current examination, this thought was in error. All future

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adverse findings or failures encountered during evaluation or operational use of U-2R life support equipment will be made known to appropriate USAF agencies (i.e., Life Support SPO, AFFTC, USAF Surgeon General's Office, etc.), within security limitations.

b. The general contents of this memorandum should be made known and discussed with all pilots using the S-1010 PPA and all support personnel maintaining such equipment. To this end, copies of this memorandum are being sent to Detachments G and H and the U-2 SPO at Warner-Robbins AFB.

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